I. Title of Application:

"Application for a Permit for Scientific Research (proposal # 01-SSL-041 recommended for funding under the SSLRI) on Steller sea lions (*Eumetopias jubatus*) under the Marine Mammal Protection Act and the Endangered Species Act."

II. Date of Application:

July 30, 2001

III. Applicant and Personnel

A. Applicant/PI:

Dr. Glenn R. VanBlaricom
Washington Cooperative Fish and Wildlife Research Unit
School of Aquatic and Fishery Sciences, Box 355020
University of Washington, Seattle, Washington 98195-5020 USA
206-543-6475, glennvb@u.washington.edu

Co-investigators:

Dr. Mary F. Willson
School of Fisheries and Ocean Sciences
University of Alaska Fairbanks
Juneau, Alaska 99801 USA
907-789-1412, mwillson@gci.net

Laura Litzky
Washington Cooperative Fish and Wildlife Research Unit
School of Aquatic and Fishery Sciences, Box 355020
University of Washington, Seattle, Washington 98195-5020 USA
206-221-5453; fax 206-616-9012; llitzky@u.washington.edu

Dr. Robert E. Synovec
Department of Chemistry, Box 351700
University of Washington, Seattle, WA 98195-1700 USA
206-685-2328, synovec@chem.washington.edu

Dr. Sara J. Iverson
Department of Biology
Dalhousie University
Halifax, Nova Scotia B3H 4J1, Canada
902-494-2566, siverson@is.dal.ca

Research Assistants:

Scott Gende
Jamie Womble

B. Qualifications and Experience:

1. Glenn VanBlaricom

University Education:

Bachelor of Science, Oceanography, with College Honors
University of Washington, 1972

Bachelor of Science, Zoology, *Magna cum Laude*
University of Washington, 1972

Doctor of Philosophy, Oceanography
Scripps Institution of Oceanography
University of California, San Diego, 1978

Present Positions:

Assistant Unit Leader, Wildlife
Washington Cooperative Fish and Wildlife Research Unit
School of Aquatic and Fishery Sciences
University of Washington, Seattle (since 1993)

Associate Professor
School of Aquatic and Fishery Sciences
University of Washington, Seattle (since 1993)

Adjunct Associate Professor
College of Forest Resources
University of Washington, Seattle (since 1993)

Adjunct Associate Professor
Department of Natural Resource Sciences
Washington State University, Pullman (since 1994)

Honors:

-Excellence in Scientific Communication Award, Society for Marine Mammalogy, 1993.
-Natural Resource Response Award for Exceptional Service, U. S. Department of the Interior, 1990.
-Special Achievement Award, U. S. Fish and Wildlife Service, 1985 & 1989.
-Dr. Betty S. Davis Conservation Award, Friends of the Sea Otter, 1987.
-Phi Beta Kappa, 1972.
-National Merit Scholar, 1967.

Qualifications:

Glenn VanBlaricom is an Associate Professor in Aquatic and Fishery Sciences, and Assistant Leader (Wildlife) of the Washington Cooperative Fish and Wildlife Research Unit, at the University of Washington in Seattle, WA. VanBlaricom currently has a research group of 10 graduate students (5 PhD, 5 MS). Four doctoral and five Masters students have graduated from the Program since 1993. VanBlaricom has 40 publications and has made 116 research presentations, including 49 invited presentations. He has served two stints (8 yrs total) on the Board of Governors of the Society for Marine Mammalogy, and is a former member of the Board of Editorial Advisors and Referees of the international research journal Marine Ecology Progress Series. The VanBlaricom research group is interested in the community ecology and conservation biology of marine mammal populations, with particular emphasis on coastal species in the North Pacific Rim and the Arctic Region. Current activities include population dynamics and habitat use patterns of belugas and narwhals in Alaska, population structure and foraging ecology of pinnipeds in the Bering Sea and northern Gulf of Alaska, assessments of killer whale populations in the Bering Sea and northern Gulf of Alaska, pinniped-salmonid interactions in Puget Sound, population dynamics of western gray whales in the Russian Far East, effects of the purse-seine tuna fishery on dolphin populations in the eastern Tropical Pacific, and assessments of minke whale and humpback whale populations in the southwestern Atlantic Region.

Recent publications:

Gerber, L.R., and G.R. VanBlaricom. In press. Implications of three viability models for the conservation status of the western population of Steller's sea lion. Biological Conservation.

Shima, M., A.B. Hollowed, and G.R. VanBlaricom. In press. Spatial distribution of walleye pollock (Theragra chalcogramma) in the Gulf of Alaska. Fishery Bulletin.

Pollard, S., G.R. VanBlaricom, and A.A. Shelly. In press. Restored top carnivores as detriments to the performance of marine protected areas intended for fishery sustainability: A case study with red abalones and sea otters. Conservation Biology.

Foster, M.S., and G.R. VanBlaricom. In press. Spatial variation in kelp forest communities along the Big Sur Coast of central California, USA. Cryptogamie Algologie.

Huber, H.R., S.J. Jeffries, R.F. Brown, R.L. DeLong, and G.R. VanBlaricom. 2001. Correcting aerial survey counts of harbor seals (Phoca vitulina richardsi) in Washington and Oregon. Marine Mammal Science 17: 276-293.

VanBlaricom, G.R., L. R. Gerber, and R. L. Brownell, Jr. 2001. Extinctions of marine mammals. Pages 37-69 in S. A. Levin (editor). Encyclopedia of biodiversity, volume 4. Academic Press, San Diego, California.

VanBlaricom, G.R. 2001. Book Review: "Biology of Marine Mammals", edited by J.E. Reynolds III and S.A. Rommel. Marine Mammal Science 17: 202-205.

Melin, S.R., R.L. DeLong, J.A. Thomason, and G.R. VanBlaricom. 2000. Attendance patterns of California sea lion (Zalophus californianus) females and pups during the non-breeding season at San Miguel Island. Marine Mammal Science 16: 169-185.

Shima, M., A.B. Hollowed, and G.R. VanBlaricom. 2000. Response of pinniped populations to directed harvest, climate variability, and commercial fishery activity: A comparative analysis. Reviews in Fisheries Science 8: 89-124.

Submitted paper currently in formal review:
Carter, S.K., and G.R. VanBlaricom. Effects of experimental harvest on red sea urchins, Strongylocentrotus franciscanus, in northern Washington. Fishery Bulletin.

2. Mary F. Willson

University Education: Bachelor of Arts, Biology
Grinnell College, Grinnell, Iowa, 1960

Doctor of Philosophy, Zoology
University of Washington, 1964

Present Positions: Principal Research Associate, Institute of Arctic Biology, and Affiliate Professor of Zoology and Botany, University of Alaska Fairbanks (since 1990).

Affiliate Professor, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks (located in Juneau) (since 1999)

Adjunct Professor, Dept. of Wildlife Ecology and Conservation, University of Florida, Gainesville (since 1999).

Recent Publications:
Robards, M.D., M. F. Willson, R. H. Armstrong, and J. F. Piatt. 1999. Sand lance (Ammodytes): Biology, ecology, and annotated bibliography. PNW-RP 521: 1-327.

Willson, M. F., R. H. Armstrong, M. D. Robards, and J. F. Piatt. 1999. Sand lance as cornerstone prey for wildlife predators. (chapter in the above report).

Sieving, K. E. and M. F. Willson. 1999. Temporal pattern of Steller's jay predation on eggs. Canadian Journal of Zoology 77: 1829-1834.

Hickey, J. R., R. Flynn, S. Buskirk, K. G. Gerow, and M. F. Willson. 1999. An evaluation of a mammalian predator, Martes americana,as a disperser of seeds. Oikos 87: 499-508.

Halupka, K. C., M. D. Bryant, M. F. Willson, and F. H. Everest. 2000. Biological characteristics and population status of anadromous salmon in Southeast Alaska. PNW-GTR 468.

Willson, M. F. and S. M. Gende. 2000. Nesting success of forest birds in Southeast Alaska and adjacent Canada. Condor 102: 314-325.

Whelan, C. J., K. A. Schmidt, B. B. Steele, and M. F. Willson. 2000. Linking consumer -resource theory and digestive physiology: application to seasonal diet shifts. Evolutionary Ecology Research 2: 1-24.

Willson, M. F., S. M. Gende, and P. A. Bisson. In press. Anadromous fishes as ecological links between ocean, fresh water, and land. INTECOL (a symposium volume edited by Gary Polis, Gary Huxel, and Mary Power, expected 2001).

Sieving, K. E., M. F. Willson, and T. L. De Santo. In press. Defining corridor functions for endemic birds in fragmented south-temperate rainforest. Conservation Biology.

Gende, S. M. and M. F. Willson. In press. Passerine densities in riparian forests of Southeast Alaska: potential effects of anadromous spawning salmon. Condor.

Submitted Papers Currently in Formal Review:
Gende, S. M., J. N. Womble, M. F. Willson, and B. H. Marston. Cooperative foraging by Steller sea lions (Eumetopias jubatus). Canadian Field-Naturalist.

Willson, M. F., B. H. Marston, and S. M. Gende. Fishing success of gulls at a Southeast Alaska smelt run. Journal of Field Ornithology.

Gende, S. M., T. P. Quinn, and M. F. Willson. Patterns of salmon consumption by bears. Oecologia.

3. Laura Litzky

University Education:	Bachelor of Science, Food Science, with College Honors University of California, Berkeley, 1993
	Master of Science, School of Aquatic and Fishery Science University of Washington, 2001
Present Position:	Research Assistant University of Washington
Honors:	-University of California, Berkeley Dean's Honor List 1993 -Order of Omega and Alpha society for academic achievement.

Qualifications:
Laura Litzky is a graduate student and research assistant in the School of Aquatic and Fishery Sciences (SAFS) at the University of Washington (UW). Her Master's work focused on the population dynamics of Cook Inlet, Alaska beluga whales, and on the development of a new technique to monitor recovery of the stock. Upon completion of her Master's thesis this year, Ms. Litzky will begin a doctoral program through the UW SAFS. The focus of her Ph.D. work will be pinniped dietary assessment by analyses of fatty acids from blubber. Ms. Litzky studied Food Science at the University of California, Berkeley and has experience with dietary studies including captive feeding studies, bomb calorimetry and gas liquid chromatography. She has worked with marine mammals for 10 years. Her marine mammal experience includes: (1) training and husbandry of bottlenose dolphins at the Kewalo Basin Marine Mammal Laboratory; (2) capture, tube feeding, husbandry and release of California sea lions and elephant seals at the Marine Mammal Center; (3) training and husbandry of

California sea lions at the Santa Barbara Zoological Gardens; (4) capture, tagging and tissue sampling of beluga whales in Cook Inlet (with the National Marine Mammal Laboratory) and Point Lay (with the North Slope Borough), Alaska. Thus, Ms. Litzky has extensive experience in both field and captive settings capturing, handling, and sampling small cetaceans and pinnipeds.

Recent publications:

Litzky, L.K., R.C. Hobbs, B.A. Mahoney. In press. Field Report for Tagging Study of Beluga Whales in Cook Inlet, AK, September, 2000. Annual Rept. to MMPA, Office of Protected Resources (F/PR) NOAA.

Moore, S. E., K. E. W. Shelden, L. K. Litzky, B. A. Mahoney and D. J. Rugh. In press. Beluga, Delphinapterus leucas, habitat associations in Cook Inlet, Alaska. Mar. Fish. Rev.

Rugh, D.J., K.E.W. Shelden, B.A. Mahoney, and L.K. Litzky. In press. Aerial surveys of beluga in Cook Inlet, Alaska, June 2000. In: Anita L. Lopez and Douglas P. DeMaster, editors, MMPA and ESA implementation program 2000. U.S. Department of Commerce, Seattle, WA.

Rugh, D.J., K.E.W. Shelden, B.A. Mahoney, L.K. Litzky, R.C. Hobbs, and K.L. Laidre. 2000. Aerial surveys of beluga whales in Cook Inlet, Alaska, June 1999. pp. 1-10. In: Anita L. Lopez and Douglas P. DeMaster, editors, MMPA and ESA implementation program 1999. U.S. Department of Commerce, Seattle, WA. (AFSC Processed Report 2000-11). 195 p.

4. Robert Synovec

University Education: Bachelor of Arts, Summa cum Laude
Bethel College, St. Paul, Minnesota, 1981

Doctor of Philosophy, Analytical Chemistry
Iowa State University, 1986

Present Position: Associate Professor
Department of Chemistry
University of Washington, Seattle (since 1992)

Honors:
-Amersham Pharmacia Professor in Residence, Molecular Dynamics, 2000
-Visiting Faculty, Royal Golden Jubilee PhD Program, Chiang Mai University, Chiang Mai, Thailand, 1999
-DuPont Educational Aid Grant, DuPont, 1999
-Excellence in Graduate Research Award, Iowa State University, 1986
-Phillips Petroleum Fellowship in Analytical Chemistry, Iowa State University, 1985-1986
-ACS Fellowship, ACS Division of Analytical Chemistry, 1984
-Alpha Chi Sigma Graduate Research Award in Analytical Chemistry, Iowa State University, 1984

Qualifications:
Rob Synovec is an Associate Professor of Chemistry at the University of Washington in Seattle WA. Synovec currently has a research group of 5 graduate students, 1 postdoctoral research scientist, 1 visiting scientist, 2 undergraduate students and has graduated 16 Ph.D. students since 1991. He has 92 publications, and 241 research presentations of which 86 are invited lectures and invited presentations. He is also an associate editor for the international journal TALANTA. His group is actively involved with the Center for Process Analytical Chemistry (CPAC). The Synovec research group is interested in process control for on-line analysis, biomedical and remote environmental analysis. We are also interested in chemical separation and detection theory for macromolecule chemical analysis. The group is interested in developing improved microbore and capillary chromatographic analysis separation, detection, and quantification techniques, and in particular the development of multidimensional chromatography combined with chemometric data analysis tools. We also work in

the areas of flow injection analysis and the development of pollution-free RP-HPLC using a water mobile phase and novel stationary phases. We study the fundamental interactions of analytes at water/polymer, water/air and liquid/liquid interfaces using novel chromatographic and surface tension measurements.

Selected Recent Publications:

"Standardization of Second-Order Chromatographic/Spectroscopic Data for Optimum Chemical Analysis," B.J. Prazen, R.E. Synovec and B.R. Kowalski, Anal. Chem., 1998, 70, 218-225.

"Comprehensive Two-Dimensional High Speed Gas Chromatography with Chemometric Analysis," C.A. Bruckner, B.J. Prazen and R.E. Synovec, Anal. Chem., 1998, 70, 2796-2804.

"Second Order Chemometric Standardization for High Speed Hyphenated Gas Chromatography: Analysis of GC/MS and Comprehensive GC x GC Data," B.J. Prazen, C.A. Bruckner, R.E. Synovec and B.R. Kowalski, J. Microcolumn Separations, 1999, 11, 97-107.

"Comprehensive LC x GC for Enhanced Headspace Analysis," W.W.C.Quigley, C.G.Fraga and R.E. Synovec, J. Microcolumn Separations, 2000, 12, 160-166.

"Enhancing the Limit of Detection for Comprehensive GC x GC using Bilinear Chemometric Analysis," C. G.Fraga, B. J. Prazen and R. E.Synovec, J. High Resolut.Chromatogr., 2000, 23, 215-224.

"Rapid Polymeric Surfactant Characterization using a Novel Flow-Injection System and Dynamic Surface Tension Detection," K. E. Miller and R. E. Synovec, Anal. Chim. Acta, 2000, 214, 149-160.

"Multidimensional Analysis of Poly(ethylene glycols) by Size Exclusion Chromatography and Dynamic Surface Tension Detection," K. E. Miller, E. Bramanti, B. J. Prazen, M. Prezhdo, K. J. Skogerboe and R. E. Synovec, Anal. Chem., 2000, 72, 4372-4380.

"Increasing the Number of Analyzable Peaks in Comprehensive Two-Dimensional Separations through Chemometrics, C. G. Fraga, C. A. Bruckner and R. E. Synovec, Anal. Chem., 2001, 73, 675-683.

"Pattern Recognition of Jet Fuels: Comprehensive GC x GC with ANOVA-Based Feature Selection and Principal Component Analysis," K. J. Johnson and R. E. Synovec J. Chemom. Intell. Lab. Syst., 2001, accepted and in press.

5. Sara Iverson

University Education: Bachelor of Science, Zoology
Duke University, Durham, North Carolina, 1979

Doctor of Philosophy, Nutritional Sciences
University of Maryland, College Park, 1988

Selected Appointments and Professional Positions:

Associate Professor, Department of Biology, Dalhousie University, Halifax, Nova Scotia. 1999 - present. (Assistant Professor, 1994 - 1999).

Research Associate, Smithsonian Institution, Department of Zoological Research, National Zoological Park, Washington D. C. 1990 - 2000.

Research Associate and NSERC International Fellow, Canadian Institute of Fisheries Technology, Technical University of Nova Scotia, Halifax, Nova Scotia. 1991 - 1994.

Faculty Research Associate, Georgetown University Medical Center, Division of Developmental Biology and Nutrition, Department of Pediatrics, Washington D. C. 1988-1990.

Selected Academic Awards and Honours:

-The Killam Prize for Research, Faculty of Science, Dalhousie University, Halifax, NS, 2000-2001.
-NSERC (Natural Sciences and Engineering Research Council, Canada) E. W. R. Steacie Memorial Fellowship (Research). July 1998-June 2000.
-NSERC Women's Faculty Award (Dalhousie University). August 1994-June 1998, July 2000-August 2001 (interrupted for Steacie Fellowship).
-NSERC International Postdoctoral Fellowship (Technical University of Nova Scotia). 1992-1994.
-Postdoctoral Research Fellowship, American Heart Association (Georgetown University Medical Center, Washington DC). 1989-1990.

*Selected Publications (*denotes student supervised):*

Iverson, S. J. (in press) Blubber. in Perrin, W. F., Wursig, B. and Thewissen, H. G. M., eds. Encyclopedia of Marine Mammals. Academic Press, San Diego.

Hood, W. R., Kunz, T. J., Oftedal, O. T., Iverson, S. J., LeBlanc, D.and Seyjagat, J. (2001) Inter- and intraspecific variation in proximate, mineral, and fatty acid composition of milk in old world fruit bats (Chiroptera: Pteropodidae). Physiol. Biochem. Zool. 74: 134-146.

*Beck, C.A., Bowen, W. D. and Iverson, S. J. (2000) Seasonal changes in buoyancy and diving behaviour of adult grey seals. Journal of Experimental Biology 203: 2323-2330.

*Kirsch, P. E., Iverson, S. J. and Bowen W. D. (2000) Effect of diet on body composition and blubber fatty acids in captive harp seals (Phoca groenlandica). Physiol. Biochem. Zool. 73: 45-59.

*Logan, M. S., Iverson, S. J., Ruzzante, D. E., Walde, S. J., Machi, P. J., Alonso, M. F. & Cussac, V. E. (2000) Long term diet differences between morphs in trophically polymorphic Percichthys trucha populations from the southern Andes. Biol. J. Linnean Soc. 69: 599-616.

*Mellish, J. E., Iverson, S. J. and Bowen, W. D. (2000) Metabolic compensation during high energy output in fasting, lactating grey seals (Halichoerus grypus): metabolic ceilings revisited. Proc. Roy. Soc. Lond. B 267: 1245-1251.

*Mellish, J. E., Iverson, S. J. & Bowen, W. D. (1999) Individual variation in maternal energy allocation and milk production in grey seals and consequences for pup growth and weaning characteristics. Physiol. Biochem. Zool. 67:677-690.

*Mellish, J. E., Iverson, S. J., Bowen, W. D. and Hammill, M. O. (1999) Fat transfer and energetics during lactation in the hooded seal: the roles of tissue lipoprotein lipase in milk fat secretion and pup blubber deposition. J. Comp. Physiol. B 169: 377-390.

*Kirsch, P. E., Iverson, S. J., Bowen, W. D., Kerr, S. and Ackman, R. G. (1998) Dietary effects on the fatty acid signatures of whole Atlantic cod (Gadus morhua). Can. J. Fish. Aquatic Sci. 55:1378-1386.

Iverson, S. J., Arnould, J. P. Y. and Boyd, I. L. (1997) Milk fatty acid signatures indicate both major and minor shifts in diet of lactating Antarctic fur seals. Can. J. Zool. 75: 188-197.

Iverson, S. J., Frost, K. J. and Lowry, L. L. (1997) Fatty acid signatures reveal fine scale structure of foraging distribution of harbor seals and their prey in Prince William Sound, Alaska. Marine Ecology Progress Series 151: 255-271.

Smith, S., Iverson, S. J. & Bowen, W. D. (1997) Fatty acid signatures and classification trees: new tools for investigating the foraging ecology of seals. Can. J. Fish. Aquatic Sci. 54: 1377-1386.

*Koopman, H.N., Iverson, S. J. & Gaskin, D. (1996) Stratification and age-related differences in blubber fatty acids of the male harbour porpoise (Phocoena phocoena). J. Comp. Physiol. 165: 628-639.

Iverson, S. J., Hamosh, M. and Bowen, W. D. (1995). Lipoprotein lipase activity and its relationship to high milk fat transfer during lactation in grey seals. J. Comp. Physiol. 165: 384-395.

Iverson, S. J. and Oftedal, O. T. (1995) Phylogenetic and ecological variation in the fatty acid composition of milks. Pages 789-827 in R. G. Jensen, ed., The Handbook of Milk Composition. Academic Press, Inc., Orlando.

Iverson, S. J., Oftedal, O. T., Bowen, W. D., Boness, D. J. and Sampugna, J. (1995) Prenatal and postnatal transfer of fatty acids from mother to pup in the hooded seal. J. Comp. Physiol. 165: 1-12.

Hamosh, M., Iverson, S. J., Kirk, C, K, and Hamosh, P. (1994) Milk lipids and neonatal fat digestion: relationship between fatty acid composition, endogenous and exogenous digestive enzymes and digestion of milk fat. World Rev. Nutr. Diet 75: 86-91.

Iverson, S. J. (1993) Milk secretion in marine mammals in relation to foraging: can milk fatty acids predict diet? Symposium of the Zoological Society of London, 66: 263-291.

Iverson, S. J. and Oftedal, O. T. (1992) Fatty acid composition of black bear (Ursus americanus) milk during and after the period of winter dormancy. Lipids 27: 940-943.

Iverson, S. J., Sampugna, J. and Oftedal, O. T. (1992) Positional specificity of gastric hydrolysis of n-3 polyunsaturated fatty acids of seal milk triglycerides. Lipids 27: 870-878.

Relevant Papers Submitted:

*Budge, S. M., Iverson, S. J., Bowen, W. D. & Ackman, R. G. (in review) Fatty acid signatures as ecological tools in monitoring diet and distribution of North Atlantic fish. Can. J. Fish. Aquat. Sci.

*Hooker, S. K., Iverson, S. J., Ostrom, P. & Smith, S. C. (in review) Aspects of diet in northern bottlenose whales in the Gully as inferred through fatty acid and stable isotope analyses of biopsy samples. Can. J. Zool.

Iverson, S. J., Field, C., Bowen, W. D. & Blanchard, W. (in review) Quantitative fatty acid signature analysis: a new method of estimating predator diets. Ecological Monographs.

Iverson, S. J., Frost, K. A. and Lang, S. (in review) Fat content and fatty acid composition of forage fish in Prince William Sound: variation with species, diet and seasonal blooms. Mar. Ecol. Prog. Ser.

Iverson, S.J., *Lang, S. and *Cooper, M. (in review) Underestimation of lipid content using the Bligh and Dyer total lipid extraction method. Lipids.

Iverson, S. J., MacDonald, J. and *Smith, L. K. (in review) Response of individual free-ranging black bears to years of contrasting food availability revealed through milk fatty acids. Can. J. Zool.

6. Scott Gende
   University Education: Bachelor of Science, Fisheries and Wildlife Biology
   Iowa State University, May, 1992

Master of Science, Fisheries
University of Alaska-Fairbanks, May, 1996

Doctor of Philosophy, School of Aquatic and Fishery Sciences
University of Washington, Expected completion winter, 2001/02

Present Position: Ecologist, Pacific Northwest Research Station, USDA Forest Service

Qualifications:
Mr. Gende is an employee of the U.S. Forest Service and doctoral student at the UW SAFS. He has worked in southeast Alaska for the past 6 years. His knowledge of the area will be extremely valuable for locating sampling sites and operating around Steller sea lion haul-outs.

Recent publications:
Willson, M. F., S. M. Gende, and B. H. Marston. 1997. Wildlife habitat models and land management plans: Lessons from the bald eagle (*Haliaeetus leucocephalus*) in Tongass National Forest. Natural Areas Journal 17: 26-29.

Gende, S. M., M. F. Willson, and M. Jacobson. 1997. Reproductive success of bald eagles (*Haliaeetus leucocephalus*) and its association with habitat or landscape features and weather in southeast Alaska. Canadian Journal of Zoology 75: 1595-1604.

Gende, S. M. and M. F. Willson. 1997. Supplemental feeding experiments of nesting bald eagles in southeast Alaska. Journal of Field Ornithology 68: 590-601.

Gende, S. M., M. F. Willson, B. H. Marston, M. Jacobson, and W. P. Smith. 1998. Bald eagle nesting density and success in relation to distance from clearcut logging in southeast Alaska. Biological Conservation 83: 121-126.

Willson, M. F., S. M. Gende, and B. H. Marston. 1998. Fishes and the forest: Expanding perspectives on fish-wildlife interactions. BioScience 48: 455-462.

Willson, M. F. and S. M. Gende. 2000. Nesting success of forest birds in southeast Alaska and adjacent Canada. Condor 102: 314-325.

Gende, S. M. and M. F. Willson. 2001. Passerine densities in riparian forests of southeast Alaska: potential role of anadromous salmon. Condor 103: 624-629.

Gende, S. M., T. P. Quinn, and M. F. Willson. 2001. Consumption choice by bears feeding on salmon. Oecologia 127: 372-382.

Papers in press:
Gende, S. M., J. N. Womble, M. F. Willson, and B. H. Marston. Cooperative foraging by Steller sea lions. Canadian Field-Naturalist

Gende, S. M. Perspectives on the nesting ecology of bald eagles in southeast Alaska. In: Bald eagles in Alaska. B. N. Wright and P. N. Schempf, eds.

Marston, B. H., M. F. Willson, and S. M. Gende. Predator aggregations at a eaulachon (*Thaleichthys pacificus*) spawning run. Marine Ecology Progress Series.

Willson, M. F., S. M. Gende, and P. A. Bisson. Anadromous fishes as ecological links between oceans, fresh water, and land. *In* G. Polis, M. Power, and G. Huxel (eds.), Foodwebs at the landscape level. University of Chicago Press, Chicago, IL.

7. Jamie Womble

University Education: Bachelor of Science, Finance
Appalachian State University, Boone, North Carolina, 1992

Bachelor of Science, Biology
University of Alaska Southeast, Juneau, Alaska, 1998

Master of Science (candidate), School of Fisheries and Ocean Sciences
University of Alaska Fairbanks, Juneau, Alaska

Present Position: Graduate Student (M. S.)
School of Fisheries and Ocean Sciences
University of Alaska Fairbanks

Honors: -Rasmuson Fisheries Research Fellowship, Univ. of Alaska Fairbanks 2001
-Beta Beta Beta Biological Honor Society, Appalachian State University
-Gamma Beta Phi National Honor Society, Appalachian State University

Qualifications:
Jamie N. Womble is a graduate student in the School of Fisheries and Ocean Sciences (SFOS) at the University of Alaska Fairbanks. Her thesis research is focused on the spatial ecology of Steller sea lions and forage fish aggregations in southeastern Alaska using a geographical information system (GIS) approach. In addition, Ms. Womble is involved with aerial surveys of Steller sea lions and scat collection in southeastern Alaska to determine seasonal distribution and diet. She has extensive field experience working on marine mammal, fish, and bird research projects in Alaska.

Recent Publications:
Gende, S. M., Womble, J.N., Willson, M.F., and Marston, B.H. *In press.* Cooperative foraging by Steller sea lions (*Eumetopias jubatus*). Canadian Field Naturalist.

Womble, J.N. and Kelly, B.P. 2001. Behavior of humpback whales (*Megaptera novaeangliae*) at Point Adolphus. Final Report to National Park Service, Glacier Bay National Park and Preserve, Gustavus, Alaska.

Mathews, E.A., Womble, J.N. 1997. Abundance and distribution of harbor seals from Icy Bay to Icy Strait, Southeast Alaska during August 1996, with recommendations for a population trend route. *In:* Small, R.J. (ed.), Harbor Seal Investigations in Alaska Annual Report. NOAA Grant NA57FX0367. Alaska Department of Fish and Game, Division of Wildlife Conservation, 333 Raspberry Road, Anchorage, Alaska 99518.

Number of individuals: Collection, storage, processing and export of samples will be overseen by the investigators: Litzky, VanBlaricom, or Willson. At least three individuals will be required for sample collection in the field: (1) boat driver, (2) sample collector, (3) technician to provide support. Listed investigators or personnel will rotate through these positions. Synovec and Iverson will only be involved in processing of the samples.

IV. Proposal

A. Summary: Annual runs or spawning aggregations of herring, capelin, sand lance and eulachon provide Steller sea lions with ephemeral access to high quality (energy rich) food. Such foraging opportunities may be more available to the eastern population of Steller sea lions than to the western population, and may underlie regional differences in population dynamics of sea lions. Fish species have unique fatty acid compositions that undergo minimal changes when ingested by pinnipeds. Thus, prey selection can be assessed by analyzing the fatty acid composition of pinniped blubber. The primary objective of this work is to obtain an assessment of the presence of fatty acid signatures from ephemeral, high-quality prey in free-ranging Steller sea lion blubber for both the western and eastern populations, and evaluate the relative contribution of such prey to blubber stores and diet. Blubber samples will be collected from Steller sea lions in the Aleutian Islands, the Gulf of Alaska

and Southeast Alaska using biopsy darts fired from rifles or cross-bows. Fatty acids will be extracted from the blubber and analyzed using gas chromatography in laboratories located in Seattle, Washington and Halifax, Nova Scotia, Canada.

B. Introduction

1. Hypothesis/Objectives: The work to be undertaken involves the collection of blubber biopsies from free ranging Steller sea lions in both the western and eastern populations in Alaska to determine access to ephemeral high-quality prey aggregations. Such access could influence sea lion demography in two distinct and important ways. Use of ephemeral feeding opportunities by juveniles may influence geographic variation in the pattern of juvenile survival rate. Juvenile survival is a matter of particular concern in the decline of the western stock of Steller sea lions. Use of ephemeral feeding opportunities by adults, particularly in the spring immediately prior to the breeding season, may have a direct influence on variation in individual reproductive fitness of both males and females, and could also influence pup survival prior to weaning. We will test the null hypothesis that there is no difference in use of ephemeral high-quality prey between the western and eastern populations of Steller sea lions by measuring the quantitative contribution of fatty acid signatures from prey species in sea lion blubber stores. Whenever possible this research will be conducted in conjunction with the National Marine Mammal Laboratory (NMML)(permit # 782-1532-00) or the Alaska Department of Fish and Game (ADFG) under their respective research permits. However, sampling must occur relative to the timing of specific runs of fish, which requires the flexibility of an additional permit outside these agencies.

2. Status of the Affected Stock(s)

a. **Species description:** We request authority to take Steller sea lions (*Eumetopias jubatus*) during 3 years of continuing research, through 31 December 2004. This request includes animals from both the eastern and western stocks (east and west of 144° W longitude, respectively). We request authority to take northern fur seals (*Callorhinus ursinus*) and harbor seals (*Phoca vitulina richardsi*) by inadvertent disturbance during operations that may overlap with these species' habitats when sampling Steller sea lions in Southeast Alaska, the Gulf of Alaska, and the Aleutian Islands.

b. **Life History and Population Status:** *Status of Affected Population and Stocks*: The abundance of Steller sea lions has declined over much of the species' range since the 1970s (Braham et al. 1980, Merrick et al. 1987, National Marine Fisheries Service 1992, National Marine Fisheries Service 1995). The estimated total population for two decades prior to the decline was 250,000 to 300,000 animals (Kenyon and Rice 1961, Loughlin et al. 1984). The population estimate declined by 50-60% to about 116,000 animals by 1989 (Loughlin et al. 1992), and by an additional 15% by 1994 (Sease et al., in press). The decline has been restricted to the western stock, which continued to decrease by about 5% per year during the 1990s. During this same time, the eastern stock has remained stable or increased by several percent per year, in Southeast Alaska (Strick et al. 1997, Sease et al. 1999, Sease and Loughlin 1999), British Columbia, Canada (P. Olesiuk, Department of Fisheries and Oceans, unpubl. data), and Oregon (R. Brown, Oregon Department of Fish and Wildlife, unpubl. data). Approximately 60% of Steller sea lions belong to the western stock, 40% to the eastern stock (Sease et al., in press).

Steller sea lions were listed as "threatened" range-wide under the U.S. Endangered Species Act (ESA) on 26 November 1990 (55 Federal Register 49204). The population includes two stocks (eastern and western), separated at 144º W longitude (Loughlin 1997). The western stock was listed as "endangered" under the ESA on 4 May 1997 and the eastern stock remains classified as "threatened" (62 FR 24345). Steller sea lions are listed as "depleted" under the MMPA.

Northern fur seals are listed as depleted under the Marine Mammal Protection Act. The fur seal population at Bogoslof Island, in the southeastern Bering Sea, the only fur seals directly affected by the research proposed in this application, has grown at a rate in excess of 50% per year since the first pup count in 1980 (Ream et al. 1999). A thorough description of the status of northern fur seals is contained in the NMML's application for MMPA Permit #782-1455 for research on northern fur seals, which is on file with the Permits Office.

A detailed description of the status of harbor seals in Alaska is contained in the NMML's application for MMPA Permit #782-1355 for research on harbor seals, which is on file with the Permits Office.

Factors Affecting the Population and Stock: Reduced juvenile survival appears to be the proximate cause of decline in the Steller sea lion population since the early 1980's. Modeling work by York (1994) found that reductions in juvenile survival could most easily produce the declines that had been observed. This hypothesis is supported by observations conducted at Marmot Island, near Kodiak, Alaska. Of 751 pups branded at Marmot Island during 1987 and 1988, only 151 individuals (20.1%) were resighted as of December 1994, and only 31 of these were resighted more than once. Through the 1997 breeding season, only 14 females were resighted on a rookery beach with a pup (Chumbley et al. 1997; NMML, unpubl. data). It is assumed that most of the missing animals have died. Observations at other sites during the period also indicated that the number of juvenile animals had declined from the pre-decline period (Merrick et al. 1988).

Despite the identification of a likely proximate cause, the ultimate cause of the decline remains unknown. Several candidates have been examined and determined unlikely to have played a major role in the decline (although they may be important factors now at the current reduced population levels): redistribution of the population, harvests (commercial or subsistence), predation by killer whales or sharks, pollutant effects, and entanglement in marine debris (Merrick et al. 1987). Disease, though probably a contributing factor, cannot in itself be considered the cause as no widespread, acute epizootics have been observed. The candidate causes have now been reduced to incidental takes in commercial fisheries, shooting by fishermen and others, and changes in the abundance or quality of the prey base. Incidental take has resulted in the death of a large number of animals and was probably important in the early declines, both in the Aleutians and the Gulf of Alaska (Loughlin et al. 1983; Loughlin and Nelson 1986; Perez and Loughlin 1991). However, it does not appear to be a major factor today because the number of takes has declined to low levels. Shooting of sea lions has long been a source of mortality, but it is difficult to assess. This, too, appears to have declined based on observations from the Copper River Delta (Wynne 1990, Wynne et al. 1992, NMFS files), the one area where shooting has been systematically monitored, and from anecdotal reports from fishermen in other areas. Thus, the cause of the recent declines appears to be a decline in the prey base available to young sea lions (Merrick et al. 1997). This may then result in a reduced nutritional plane which is translated into increased susceptibility to mortality from disease, parasitism, and predation. This would also explain the smaller size at age observed by Calkins and Goodwin (1988). However, the change in the prey base has not been identified.

3. Literature Review: Hypotheses for the current declines in Steller sea lion populations are centered on the nutritional ecology of the sea lions (see above), and generally implicate either natural large-scale environmental fluctuation or fishing effects as disrupters of food supply (e.g., VanBlaricom *et al*. 2001). In either case an understanding of foraging patterns in sea lions is important in achieving insight to causes of population declines. Steller sea lions are known to forage intensively on spawning runs or aggregations of eulachon and herring during spring in southeastern Alaska (Gende *et al.* in review). Eulachon and herring are available as prey for only short periods of a few weeks each year. Each species may provide high-quality feeding opportunities because of high mass-specific energy densities in the fish (particularly in the case of eulachon; Kuhnlein *et al*. 1982, Perez 1994), and because the fish form dense aggregations in shallow water during spawning periods. Sea lions are known to "gorge" on eulachon or herring during such opportunities. Ephemerally available spawning aggregations of eulachon, herring, and other forage species with high energy density (such as Pacific sand lance (*Ammodytes hexapterus* Pallas) or capelin (*Mallotus villosus* [Müller])), may be important to the survival and, particularly, the reproductive fitness of sea lions. An example of the potential importance of even minor amounts of high-quality prey to individuals is illustrated by recent data on juvenile harbor seals (*Phoca vitulina* L.) in Prince William Sound, Alaska (Iverson et al. 1999). Yearling seals with highest body fat contents had diets consisting of about 5% eulachon, while eulachon accounted for 25-30% of their fatty acid signature, and thus, of their

total blubber stores. Because of the high fat content of eulachon, a diet of 5% eulachon provided over one quarter of total blubber stores in the yearling seals.

A technique to determine the impact of ephemeral high-quality prey on Steller sea lions is the use of fatty acid signature analysis (Iverson et al. 1998). Dietary fatty acids of carbon chain length fourteen or greater reach the bloodstream of vertebrate carnivores unmodified by digestion, and in many cases are incorporated into tissues such as blubber chemically unchanged from the time of prey ingestion (Iverson et al. 1998). Thus, fatty acid profiles from blubber in many top-level marine carnivores are influenced strongly by the fatty acid profiles of their prey species (e.g., Rouvinen and Kiiskinen 1989, Iverson et al 1995, Kirsch et al. 2000). Since prey species have distinctive and recognizably different fatty acid profiles (Innis and Kuhnlein 1987, Sargent et al. 1988, Fraser et al. 1989, Grahl-Nielsen and Mjaavatten 1991, Iverson 1995, Iverson et al. 1997, Smith et al. 1997), analyses of the fatty acids found in Steller sea lion blubber can indicate their diet.

C. Methods

1. Justification: The final Recovery Plan for Steller sea lions (NMFS 1992) identified the need to investigate feeding ecology and factors effecting energetic status (research task 6) and specifically to describe foods eaten by sea lions (research task 611) and to assess significance of various prey (research tasks 614). In the past, most food habits research relied on analyses of fecal material and stomach contents, however, results from such analyses are biased towards the most recent feeding. This is not a problem if the diet is relatively uniform throughout the observation period. But, should there be differences (e.g., the animal eats different foods while offshore than near the haul-out) then the dietary information will be biased. Additionally, the lethal take of Steller sea lions for stomach contents is not a viable option. Instead, by the collection of a small amount of blubber, information can be gathered on an animal's diet over time. Collection of blubber from another species would not be relevant in assessing impact of ephemeral high-quality fish to Steller sea lion diet.

Examination of fatty acids in pinnipeds as indicators of diet is a recent development, and sufficient data is not available to perform a power analysis or calculate minimum sample sizes for determining diet composition. However, in the Iverson et al. (1997) analyses of fatty acid signatures in the blubber of harbor seals in Prince William Sound, Alaska, 94.8% accuracy was found in detecting differences in diet based on major haulout locations. Assuming that fatty acid signatures in the blubber of Steller sea lions would demonstrate similar variability (CV < 10%), we estimate that the a sample size of about 40 animals per area per year would provide precision ±10%, 95% of the time to detect differences in fatty acids between location groups. Because the fatty acid signatures of suckling or recently weaned pups would primarily reflect milk consumption, pups will not be considered for fatty acid analysis. Our goal will be to sample at least 40 but not more than 50 adults or juveniles in at least 2 sites per area (western and eastern populations) per year for fatty acid analysis. Some of these samples will be collected in conjunction with live captures conducted by the NMML and the ADFG.

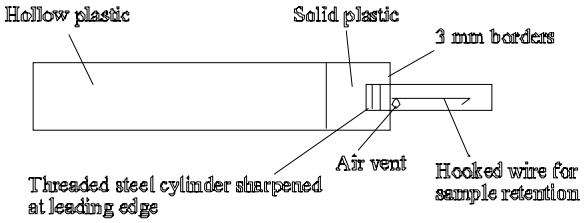
We will sample Steller sea lions on rookeries, haulouts and in the water using a modified cetacean biopsy dart fired from a rifle or cross-bow (see description in the following section 3). The technique is similar to that used by researchers to sedate animals with Telazol darting. Based on field experience under NMFS Permits #809 and #782-1447, the minimal responses of darted animals suggested that being struck by the biopsy dart was less disturbing than being struck by a Telazol dart. The potential for infection or tissue damage is minimal due to the small size of the sample. Leaving the wound open will allow it to weep should infection occur and prevent the formation of an abscess. The impact and small wound caused by the biopsy dart will be less than a bite from another sea lion (an event that commonly occurs)(Fadely, pers. comm.).

The taking of Northern fur seals or harbor seals by inadvertent disturbance will be minimal as overlap of haul-out areas with Steller sea lions is unlikely. Should these species be present during biopsy operations efforts will be made to minimize harassment by decreasing engine noise and researcher movement.

2. Duration of the Project and Locations of Taking: The overall duration of the research project is 3 years continuing through December 31, 2004. Sampling will occur primarily in the spring (March-May) of each

year, although some sampling may occur in winter (November-February) or summer (June-July) in conjunction with relevant fish runs. At least two sites will be sampled in both the western and eastern populations (sites will be chosen based on access to runs of eulachon, herring, sand lance or capelin). Thus, sampling will occur throughout the state of Alaska. Samples will be shipped from Alaska to Seattle, Washington for initial processing. From Seattle, some samples will be shipped to Dr. Iverson in Halifax, Nova Scotia, Canada for analysis.

3. Types of Taking Involved and Estimate of Numbers of Animals that Would be Taken: We will sample Steller sea lions on rookeries, haulouts and in water with a modified cetacean biopsy dart fired from a CO_2-charged rifle or cross-bow. The dart is designed to remove a 0.6cm diameter by 5-7cm long sample of blubber, skin, and fur. A border around the edge of the dart keeps it from penetrating any deeper than desired depth (5-7 cm). Our biopsy dart is very similar to that developed by Gemmell and Majluf (1997) for use with South American fur seals (*Arctocephalus australis*) and southern sea lions (*Otaria bryonia*):



Gemmell and Majluf (1997) were confident that animals showed no adverse effects to sampling, and that the only likely way to cause severe injury to a study animal was to strike them in the head. For our proposed darting attempts we will use the same general strategy as for immobilization darting which minimizes disturbance to other animals on the haulout. Animals may also be approached from the water via a small (<6 m) vessel. Format of attempts:

a) We will stalk to within about 15 meters of animals to insure: range is appropriate, ability to accurately identify age/sex classes of animals, and ability to safely dart the animal.
b) We will select target animals so as to minimize the possibility of having other animals interfere with the target animal or of hitting a non-target animal.
c) We will dart animals in the rump.

Several approaches may be necessary in order to aim the dart at a suitable sample site. Darts will be thoroughly cleaned and sterilized with alcohol, betadine, or Cold Sterile solution immediately prior to use. The force of impact of the dart causes it to expel from the animal. The dart can then be collected either free floating, or by an attached tether.

The maximum number of individuals that will be taken annually will be 240 (120 from each the western and eastern populations). We will attempt to sample sex in a ratio of 1:1. As mentioned above, only juveniles and adults will be sampled. Pregnant and lactating females may be sampled. The number of approaches on an individual animal will not exceed three. The number of actual hits with the dart on an individual animal will not exceed one. Biopsy sampling is the only way in which animals will be directly taken during this study.

SPECIES/STOCK	DIRECTED AND OPPORTUNISTIC TAKES		INCIDENTAL HARASSMENT FOR ALL RESERCH ACTIVITIES
	BIOPSY SAMPLING	# TAKES PER ANIMAL	
Steller sea lion western stock	120	3	unlimited
Steller sea lion eastern stock	120	3	unlimited
Northern fur seal	0	0	unlimited
Harbor seal	0	0	unlimited

Once collected, biopsies will be placed immediately into cholorform containing BHT (butylated hydroxytoluene) as an antioxidant and stored frozen (-20º C) until analysis (Iverson et al. 1998). Samples will be transported by air to locations described above.

Once in the laboratory, total lipid will be extracted, purified, and quantified from blubber biopsies using the standard methods of Folch et al. (1957). Fatty acid profiles will be determined in the Iverson Laboratory using temperature-programmed gas liquid chromatography as described in Iverson *et al.* (1998). In the Synovec Laboratory, analyses for fatty acid profile will be done using two-dimensional comprehensive gas chromatography (GC x GC). In comprehensive GC x GC, a sample mixture containing the fatty acids as derivatized as methyl esters is subjected to separations with two different columns, operating in concert, with different selectivity (e.g., polar and non-polar stationary phases). The resulting two-dimensional chromatogram provides a two-dimensional separation of sample components, and thus, a two-dimensional fatty acid profile. This means that full resolution on either column is generally not necessary to separate two given sample components, and the analysis can be accelerated accordingly. The net result is that GC x GC is capable of generating more information, i.e., a more informative fatty acid profile, in a shorter amount of time than conventional one-dimensional GC. Thus, the GC x GC instrument is particularly well suited to pattern recognition problems as it provides a great deal of selectivity in a relatively short length of time. The GC x GC instrument and related data analysis methodology are described in detail by Johnson and Synovec (2001).

ANOVA-based feature selection (*sensu* Johnson and Synovec 2001) will be used to separate analytically useful peaks in fatty acid gas chromatographic profiles from profile data that are less useful. The most useful features of profiles are those associated with prey species and not with intersite variance. In this project, feature selection will be used to extract useful information from the chromatographic profiles. This will be in the form of a point-by-point analysis of variance (ANOVA) calculation along the retention time axis of the GC x GC chromatograms. The ANOVA calculation provides f ratios (ratio of between class variance to within class variance) that will be used as an indicator of discrimination between classes at that particular retention time. Areas of the chromatograms that show discrimination between classes will be retained as features within the gas chromatographic profile data for further analysis. ANOVA-based feature selection can also be used with single GC chromatograms.

Classification trees (Iverson *et al.* 1997, Smith *et al.* 1997) and discriminant analyses will be used to classify individual sea lions and to assess characteristics and variation between groups of sea lions sampled. Classification trees do not require assumptions about distributional characteristics of the data and are able to accommodate the large number of different fatty acids often present in samples. Principal component analysis (PCA) and hierarchical cluster analysis (HCA) also will be used to investigate the data. PCA and HCA are considered unsupervised classification techniques in that they probe the data set for evidence of sub-clustering without the use of a training set (i.e., samples with known classifications). PCA seeks to generate a lower-dimensional orthogonal subspace that maximally describes the variance contained in the

data set while HCA examines sample-to-sample distances in the measurement space. Both techniques are useful here to probe for evidence of sample clustering.

This work (proposal # 01-SSL-041) has been recommended for funding under the Steller Sea Lion Research Initiative (see http://www.fakr.noaa.gov/omi/grants/sslri/).

a. ***Description of parts or specimen samples***: A biopsy (0.6cm diameter by 5-7cm long) of blubber, skin, and fur will be removed from sampled animals. Sample storage and transport are described above.

b. ***Removing animals from the wild/ research on captive animals***: No animals will be removed from the wild with this research.

c. ***Import/Export of Marine Mammals/Marine Mammal Parts***: Some samples will be shipped from Seattle, Washington to the laboratory of cooperating investigator Dr. Iverson at Dalhousie University in Halifax, Nova Scotia, Canada.

d. ***Lethal Take***: No intentional lethal take is involved in this research.

We do not anticipate any mortality of sea lions as a consequence of the proposed research. In the unlikely event that mortality does take place, we request the authority for no more than 2 mortalities during a given year, and no more than 5 during the duration of the permit. Should a mortality occur, project personnel will immediately review the circumstances with the goal of preventing recurrence.

4. Publication of Results: Data from our analytical results will be made available to other scientists, managers, and the general public by presentation on the web site of the Washington Cooperative Fish and Wildlife Research Unit (WACFWRU).

We anticipate a minimum of five publications in peer-reviewed periodicals as a result of this project, to be co-authored by the Principal Investigator, Co-principal investigator, Cooperating Investigators, Postdoctoral Research Associate, and Graduate Student affiliated with this project. We anticipate the likelihood of additional papers resulting from discoveries that cannot be predicted at present. Papers will be submitted primarily in the fields of marine ecology, conservation biology, marine mammal science, animal physiology, and analytical chemistry. All products of this project also will be posted on the WACFWRU web site as noted above.

This project will form the basis for the doctoral dissertation of Laura K.Litzky in the graduate program of the School of Aquatic and Fishery Sciences, University of Washington.

D. National Environmental Policy Act (NEPA) Considerations

(a) The research involves new, innovative, controversial, or experimental equipment or techniques:

Collection of samples will not involve any new, innovative, controversial or experimental equipment or techniques. Analyses of the blubber samples will involve the innovative technique of two-dimensional gas chromatography (GCxGC) developed by the laboratory of Dr. Synovec (Johnson 2001).

(b) The research techniques are likely to be adopted by other researchers:

It is likely that the GCxGC technique will be adopted by other researchers.

(c) The location in which the research will be conducted is of special importance to other marine mammals:

Some areas are utilized by other pinnipeds (harbor seals and Northern fur seals) but harassment of these animals will be minimal.

(d) The proposed activities involve unique or unknown risks or whether the likely effects are highly uncertain:

No.

(e) Any aspect of the research possibly affects the public health or safety of humans:

No.

(f) the activity may have a significant cumulative effect, considering existing and potential activities;

No, however, all activities will be coordinated through the appropriate regional offices.

(g) the activity causes loss or destruction of significant scientific, cultural, or historic resources;

No.

(h) there will be an adverse effect on endangered or threatened populations or stocks or their habitat;

No.

(i) the activity is in violation of a Federal, State, or local law for environmental protection.

No.

V. Previous and Other Permits

A. Previous Permits: NA

B. Other Permits: A Fish Resources Permit is currently being sought from the Alaska Department of Fish and Game in connection with this research. This permit is required for the collection of fish that must accompany this study to deduce fatty acid signatures of Steller sea lion prey.

VI. Special Considerations for Applicants Working Abroad (for Exports of Parts/Samples or Live Animals f rom the U.S.)

NA

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VIII. Certification and Signature

"I hereby certify that the foregoing information is complete, true, and correct to the best of my knowledge and belief. I understand that this information is submitted for the purpose of obtaining a permit under one or more of the following statutes and the regulations promulgated thereunder, as indicated in Section I. of this application:

The Endangered Species Act of 1973 (16 U.S.C. 1531-1543) and regulations (50 CFR 222.23(b)); and/or

The Marine Mammal Protection Act of 1972 (16 U.S.C. 1361-1407) and regulations (50 CFR Part 216); and/or

The Fur Seal Act of 1966 (16 U.S.C. 1151-1175).

I also understand that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or to penalties provided under the Endangered Species Act of 1973, the Marine Mammal Protection Act of 1972, or the Fur Seal Act of 1966, whichever are applicable."

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Steller Sea Lion Aerial Surveys: Description of Work, Justification and Methodology

Summary:

We propose to examine the geographical relationship between the location of spring spawning runs of herring (*Clupea pallasi*) and eulachon (*Thaleichthys pacificus*) in southeasterd Alaska and the location of Steller sea lion (*Eumetopias jubatus*) foraging aggregations and haul-outs using aerial surveys. Prey relationships have been suggested to contribute to the decline of western populations of sea lions. Comparisons with thriving eastern populations will help understand how theses food-web interactions function in maintaining stable sea lion populations. We will test the hypothesis that the local abundance of foraging sea lions in spring is correlated with the location of seasonal forage fish aggregations and that the seasonally occupied sea lion haul-outs are located in places that minimize swimming distances to forage fish spawning runs.

Justification

Aerial surveys will be used to document abundance and distribution of Steller sea lions in southeastern Alaska during spring 2002-2004 between the months of February and May. Aerial surveys are the most efficient way to survey Steller sea lions over a large geographic area.

All possible precautions will be taken to minimize impact of aerial surveys on Steller sea lions. Aerial surveys will be conducted using a Cessna 206 amphibious airplane with an experienced survey pilot. Survey aircraft will be flown at slow speeds (100-150 knots), at an altitude of 150-200 meters, and 500 meters offshore to minimize disturbance to Steller sea lions. If disturbance is detected, the aircraft will immediately depart from that particular area to avoid further disturbance to Steller sea lions. There are no feasible alternative methods for surveying Steller sea lion abundance and distribution over a large geographic area.

The proposed research cannot be conducted using an alternative species or stock because it is critical to determine the relationship between the distribution and abundance of Steller sea lions in the eastern population in relation to the timing and proximity of forage fish runs. A sound ecological understanding of the thriving eastern population will allow for constructive comparison to the endangered western population of Steller sea lions.

Methods:

Duration of Project and Locations of Taking:
Project duration: February through May 2002, 2003, 2004
Location: Southeast Alaska (Dixon Entrance to Cape Suckling)

Types of Taking Involved and Estimated Numbers of Animals that Would be Taken:
Method of Take: Aerial Surveys
Aerial surveys will be used to document abundance and distribution of Steller sea lions in southeastern Alaska from February through May 2002-2004. Aerial surveys will be conducted on all ages of Steller sea lions during the non-breeding season. The maximum number of individuals that may be taken annually are 19,000 Steller sea lions, which is based on an estimate of the southeastern Alaska population estimate in 1997 (Calkins et al. 1999). However, it is likely that some proportion of these animals are in the water and are not hauled out thus will not be subject to a take. All sex and ages classes during the non-breeding season will be subject to take two times per individual per year between the months of February through May (Table A). Aerial surveys of Steller sea lion haulouts in SEAK in close proximity to forage fish spawning areas will be conducted two times during spring, from February through May. The first survey will occur prior to fish spawning (control) and the second survey will occur during fish spawning (treatment) because the goal is to relate Steller sea lion distribution and abundance to timing of forage fish spawning during spring. Monthly or quarterly aerial surveys are inadequate to address this research goal.

Detailed Aerial Survey Methodology

Aerial surveys will be conducted using a Cessna 206 amphibious airplane with an experienced survey pilot between the hours of 1000 and 1600 (Withrow 1982) and ± 2 hours of low tide, because tidal state can influence the haul-out cycle of sea lions (Kastelein and Weltz 1990; Calkins et al. 1999). Survey aircraft will be flown at slow speeds (100-150 knots) and at an altitude of 150-200 meters, and 500 meters offshore. The primary observer-photographer will sit in the front right seat and photograph sea lion haulouts through an open window. All surveys will be flown with the sea lion haulout to the starboard side of plane to optimize photograph quality. Photographic slides of

haulouts will be taken using a 35mm auto-focus camera(Nikon 8008S) with a motor drive and a 70-210mm zoom lens. Color slide film (Fuji 400 ASA) will be used at a shutter speed of 1/500 of a second. The time, date, location, roll and frame numbers will be recorded for each photographed haulout. Overlapping photographs will be taken if more than one photograph is required for complete coverage of a sea lion haulout. All harbor seal (*Phoca vitulina*) haulouts will be avoided during aerial surveys to prevent possible inadvertent harassment

Anticipated Effects

Anticipated effects of proposed activity include changes in behavior of Steller sea lions at haulout sites or disruption of behavioral patterns. If changes in behavior patterns are detected, the proposed research activities will terminated immediately. Aerial surveys protocols approach distance, speed, and elevation will be strictly enforced. Survey aircraft will be flown at slow speeds (100-150 knots) and at an altitude of 150-200 meters, and 500 meters offshore.

Number of Takes
See attached table

Table A. Annual Steller Sea Lion Takes, except where noted

Task No.	Type of Take (Activities)	Spp./Age Class	# Animals	# Takes/ animal/ year	Season/Frequency	Location
1.	Aerial surveys Photograph	All ages	19,000	2	Feb. – May (2 per year)	Southeast Alaska

Experience with Aerial Surveys

Jamie N. Womble is a graduate student in the School of Fisheries and Ocean Sciences (SFOS) at the University of Alaska Fairbanks. Her thesis research is focused on the spatial ecology of Steller sea lions and forage fish aggregations in southeastern Alaska. Ms. Womble is currently involved with cooperative study between the University of Alaska and the National Marine Fisheries Service-Auke Bay Laboratory, which includes aerial surveys, scat collections, and ground counts of Steller sea lions in southeastern Alaska to determine seasonal distribution and diet. In addition, she has conducted aerial surveys of harbors seals in the Northeast Gulf of Alaska (Mathews and Womble 1997). Womble has experience with all facets of conducting aerial surveys of pinnipeds including serving as primary observer/photographer and processing and counting photographic data slides.